Author Comment to Referee #1

https://doi.org/10.5194/egusphere-2025-5609, 'Continental and marine source regions contributing to the outflow of the Asian summer monsoon anticyclone during the PHILEAS campaign in summer 2023' by B. Vogel et al.

We thank Referee #1 for the positive review and for further guidance on how to revise our manuscript. Our reply to the reviewer comments is listed in detail below. Questions and comments of the referee are shown in italics. Passages from the revised version of the manuscript are shown in blue.

Summary: This paper integrates Lagrangian transport simulations with airborne in situ observations from the 2023 PHILEAS campaign to derive insights about the source regions contributing to the composition of the Asian summer monsoon UTLS anticyclone. Three-dimensional tracer simulations as well as backward trajectory calculations from the PHILEAS flight tracks are used. The authors highlight three case studies which show the important role of marine sources (Pacific tropical cyclones in particular) that contribute to the air masses sampled by the HALO research aircraft.

Overall Thoughts: This is a well-written paper which underscores the important contribution of western Pacific air masses to the composition of the Asian monsoon UTLS region. This contribution has been identified in the past, but it has remained somewhat unappreciated, making this an important contribution. I believe this work should be published after the authors take into account my mostly minor remarks below.

Recommendation: Minor Revision

We thank Referee #1 for this very positive review. A detailed discussion about the reviewer's minor comments follows below.

General Remarks:

- *I am a bit concerned about the authors choice of 'South Asia' as the terminology to describe everything from northern Africa to eastern China, particularly for the reasons below:*

1. *The northern Africa (NAF) domain seems to go all the way to the Atlantic coast (Figure 2), which is very far from Asia. If the NAF domain makes an important contribution (I didn't personally get this impression, although line 176 suggests that it was added deliberately for this manuscript), then the authors should add a clarifying remark about why it was included as part of 'South Asia'. If not, then I suggest redefining 'South Asia' to exclude the NAF region for clarity.*

   We thank the reviewer for this comment and revised Sect. 3.1 of our manuscript as follows for better clarification.

   Our simulations show that the following surface–origin tracers contribute in general to the composition of the ASMA: Northern Indian Subcontinent (NIN), Indian Subcontinent (IND), Tibetan Plateau (TIB), Eastern China (ECH), Bay of Bengal (BoB), Northern Indian Ocean (NIO), as well as the Near East (Neast) and Northern Africa (NAF), with the latter two contributing only in small fractions. In the following, we use the sum of these surface–origin tracers as a marker for air originating from the ASMA and refer to it as the South Asia tracer (despite minor contributions from regions outside Asia).

2. *Recent results from the ACCLIP (2022) campaign have illuminated the important contribution of both South Asia and East Asia to the composition of eastward-transported ASM air masses (see for example Pan et al., 2025; https://doi.org/10.1029/2025JD044417, and several references therein). Given this, I question whether it's appropriate for these regions to be combined and referred to as 'South Asia' in this work without explanation. In particular, the prominent source of dichloromethane is 'East Asia' (i.e., China) but the authors state that elevated concentrations indicate a source from 'South Asia' (lines 9 and 262 at least) which I find misleading. I don't suggest that the analysis be totally redone, but I do think the authors should acknowledge recent literature that finds both these regions to be important, and provide a justification for why they are not considered individually in the current work.*

Many thanks for this comment. We agree that the discussion about the contribution of the Indian (South Asian) monsoon and East Asian monsoon is too short and masked within the discussion about the contributions of the different surface-origin tracers. We revised the manuscript according to the reviewer's advice as follows.

In general, the Asian summer monsoon is divided into the Indian (South Asian), East Asian, and Western North Pacific summer monsoon regions (Wang and LinHo, 2002). The role of the East Asian monsoon on the chemical composition of the ASMA was studies based on measurements taken during the ACCLIP campaign from South Korea in July and August 2022 (e.g. Smith et al., 2025; Pan et al., 2024, 2025). Compared to that, the StratoClim measurements sampled the core region of the Indian summer monsoon (e.g. Höpfner et al., 2019; Adcock et al., 2021; Vogel et al., 2024; Stroh and StratoClim-Team, 2025). The CLaMS regional surface-origin tracers can be used to link the PHILEAS measurements to sub-regions reflecting the influence of the Indian (South Asian) (surface-origin tracers: IND, NIN) and the East Asian (surface-origin tracer: ECH) as well as to the western North Pacific (surface-origin tracer: NWP) summer monsoon.

Further, we revised the conclusions as follows.

Furthermore, air masses measured in the eastward outflow of the ASMA are mainly from East China and the Western Pacific (from the region of East Asian and Western North Pacific summer monsoons) in contrast to the western part that originates mainly from the Indian subcontinent (from the region of the Indian summer monsoon).

3. *Related to the above remark, I am actually a bit perplexed that CLaMS results don't suggest a stronger contribution from 'East Asia' (e.g., Figure 3). Recent work by Jesswein et al (2025;* `https://doi.org/10.5194/acp-25-8107-2025` *) traced PHILEAS measurements to sources over East Asia. One of the flights (F08) is common between these two studies, but the results seem quite different. I understand these studies use different modeling approaches, but I think it could be*

insightful for the authors to provide some explanation for these differing results.

We agree that this is an interesting question that requires further clarification. In contrast to Jesswein et al. (2025), our study focuses on potential temperature levels of the Asian summer monsoon anticyclone (>340K). Figure 1 in this reply shows measurements from research flight F08 for potential temperatures greater than 320 K, whereas Fig. 15 in our paper only includes measurements above 340 K. The high CH_2Cl_2 mixing ratios in the first part of the flight have already been highlighted in several publications (Jesswein et al., 2025; Riese et al., 2025; Woiwode et al., 2026). Therefore, we do not discuss this part of the flight in order to avoid duplicating results from existing publications.

In Fig. 2 of this reply, the frequency distribution of the locations where air parcels were traced back from the flight track of research flight F08 on 26–27 August 2023 to the model boundary layer is shown for measurements above 340 K and above 320 K. When including the lower potential temperature range (320 K–340 K), air mass origins in East China are found in the CLaMS simulations, in agreement with Jesswein et al. (2025). Surface-origin tracer Fig. 2a of this reply confirm origins in eastern China (ECH) as well.

We added the following text for better clarification to Sect. 4.3.3 of the revised manuscript.

In our study, we focus on measurements above 340 K potential temperature, in contrast to other recent studies that include measurements from research flight F08 below this level (conducted during the first hours of the flight, which are not shown in Fig. 15). These studies link enhanced CH_2Cl_2 mixing ratios measured in this flight segment to sources in eastern China (Jesswein et al., 2025; Riese et al., 2025; Woiwode et al., 2026), which is consistent with our CLaMS simulations but which is not discussed further here.

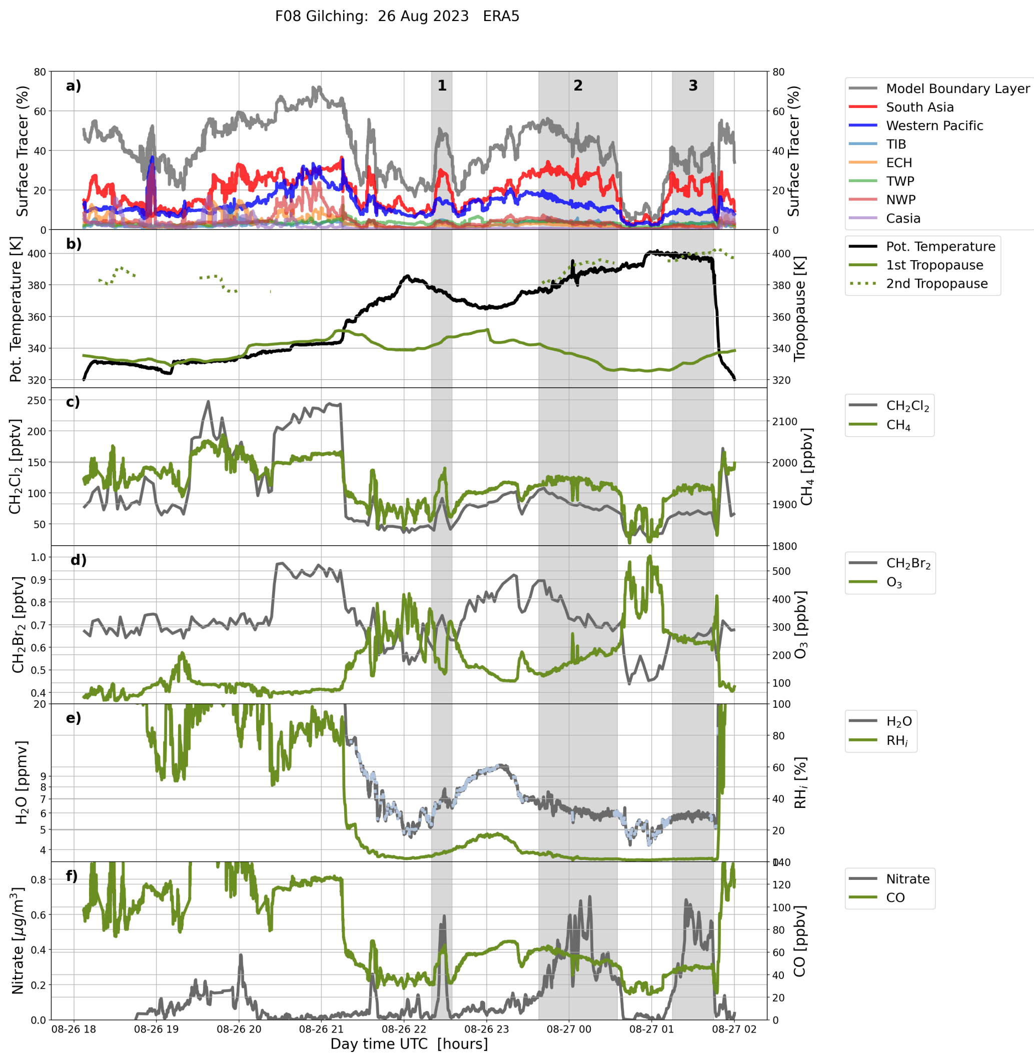

Figure 1: As in Fig. 15 of the main paper (pot. temperature > 340 K), but for potential temperatures greater than 320 K.

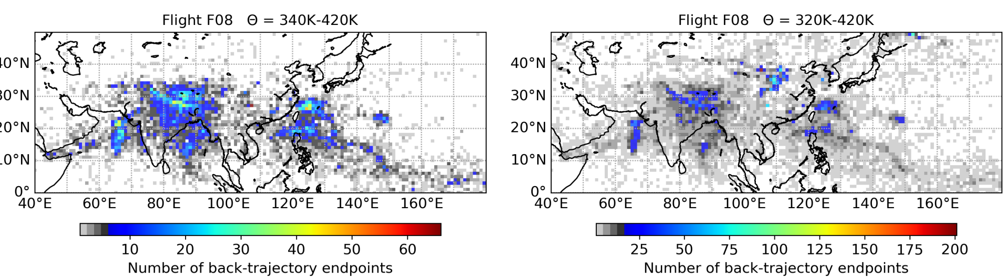

Figure 2: Frequency distribution of the locations where air parcels were traced back from the flight track of research flight F08 on 26–27 August 2023, to the model boundary layer for measurements above 340 K (left) and above 320 K (right). Note the different color bar ranges.

- *The argument that oceanic air mass influence is important for ASM UTLS composition is expertly made, however I don't expect the oceanic contribution to be important in all cases. I think that the authors should acknowledge that the research flights emphasized in this work are chosen especially because they highlight tropical cyclone influence to make the point that it can play an important role. The authors could consider additional figures in the appendix showing the top panels of figures 9, 12 and 16 but for all 20 flights if they want to conclude that this contribution is routine, but otherwise it should be clear that the conclusions are only valid for the chosen cases. More comprehensive modeling analysis over a broader region and time period (not just targeting aircraft measurements) might still be needed to make truly general statements about oceanic air mass contribution, though I expect this is outside the scope of the current work.*

  Many thanks for this comment. For better clarification we added the following sentence at the end of section 4.1 to the revised manuscript.

  For each PHILEAS flight (F02–F20), a local coincidence is found between the frequency distribution of air mass origins (for measurements above 360 K potential temperature) at least with one of the tropical cyclones shown in Fig. 4.

  Further, we refined our conclusions according to the reviewer's advice.

  Our findings show that the PHILEAS measurements are in general impacted by tropical cyclones in the western Pacific. The presented case studies demonstrate that the outer edge of the ASMA in 2023 is impacted by marine air from the western Pacific uplifted by tropical cyclones....

Technical Remarks and Typos:

1. *There are several places in the manuscript that the authors use 'western' and 'eastern' instead of 'westward' and 'eastward' when describing outflow from the ASM. I recommend using the latter terminology. Some locations I found were lines 5, 8, 76, 445, 486, and the Section 4.3.2 title, though there may be others.*

We thank the reviewer for this valuable comment. We revised the manuscript accordingly.

2. *Lines 6-7: This sentence is a bit short and general. Perhaps: 'The current work integrates PHILEAS aircraft in situ measurements with output from Lagrangian transport simulations to ...' ?*

   Yes, we agree that in general the abstract is somewhat short due to the limitation of words according the ACP rules (maximum number of word 250). However, we revised this sentence as follows.

   This work integrates PHILEAS aircraft in situ measurements with results from Lagrangian transport simulations.

3. *Line 9: maybe specify nitrate aerosol, since that seems to be the emphasis.*

   Same as above.

4. *Line 28: I would remove '(e.g., Alaska)', I don't believe the ASM air mass was sampled over Alaska, but rather that Alaska was used as a base to reach the ASM air mass to its south (over the North Pacific).*

   Many thanks for this question. The PHILEAS aircraft campaign was planned to measure the outflow from the Asian summer monsoon anticyclone over North America (including Alaska). Figure 13 and C4 in our manuscript (doi.org/10.5194/egusphere-2025-5609) demonstrate that air from the Asian summer monsoon anticyclone can reach Alaska.

5. *Line 31: remove extra 'the'*

   done

6. *Line 41: I would remove the '(in particular typhoons)' remark, or change to 'including typhoons'. All typhoons are tropical cyclones, and the latter should be considered broadly important for transport even if they're not at typhoon status.*

   done

7. *Line 54: aerosol backscatter is not a trace gas, but the sentence structure suggests that it is.*

   done

8. *Line 75: 'ASMA' typo*

   done

9. *Line 81: I suggest 'Anchorage, Alaska (USA)' since the country 'Germany' is in parentheses before this.*

   done

10. *I was a bit confused in a few spots about how F02-F20 was called '20 flights'. Numerically this should only be 19 flights. I see that there are two days that have 'subflights' (a/b) and F03 also seems to be excluded as well. I suggest adding a short clarification about this, and also mention why F03 was excluded (as F01 is mentioned in the Figure 1 caption).*

    Yes we agree, that is confusing. We added a short clarification to the caption of Figure 1.

    A total of 18 scientific flights (F02–F20; excluding the electromagnetic compatibility and turbulence calibration flights F01 and F03, and counting the double flights F07a/b and F10a/b as one flight each) were conducted between 6 August and 27 September 2023, departing from Oberpfaffenhofen (Germany) and Anchorage (Alaska).

11. *Line 88: 'database' ?*

    Replaced by data set.

12. *Line 136: The ERA5 data were retrieved on a regular horizontal grid. Were they also retrieved with a degraded vertical resolution compared to the 137 native levels? That would be a good to clarify as well.*

    Thanks. We clarified this as follows in the revised version of the manuscript.

    We used ERA5 data on native model levels, including 137 vertical levels up to 0.01 hPa, with a horizontal resolution of $0.3^{\circ} \times 0.3^{\circ}$ ($\sim$ 31 km; according to a spectral trunction of T_L 639) and an hourly time resolution.

13. *Line 155: I'm not totally comfortable with ∼2–3 km above the surface being referred to as the 'boundary layer'. I'm guessing that may be true in some places, but that altitude may be the lowermost free troposphere in others. I wonder if the authors would be comfortable renaming this layer the 'lower troposphere' throughout.*

    Yes, we agree. To avoid any misunderstandings like this we referred to as the **'model boundary layer'** instead of using the term '(planetary) boundary layer'. The model boundary layer is set when the CLaMS vertical hybrid pressure–potential–temperature coordinate (ζ) fulfils $\zeta \leq 120\,\text{K}$) that is about 2–3 km above the surface considering orography (for details, see e.g. Vogel et al., 2015, 2019).

14. *Line 184: 20 'science' flights?*

Here, we prefer 'research flights'; 'science flights' sounds more colloquial.

15. *Related to the first general remark above, I see that the north Indian Ocean (NIO) region is also included in the analysis which spans all the way into the southern hemisphere (thus far from Asia). I am left wondering whether most of the contribution from 'South Asia' comes from the land regions (where anthropogenic pollution would be found in reality) and regions like the NIO and BoB are minor.*

    Many thanks for this comment. This is an important issue. We agree that the surface-origin tracer for the northern Indian Ocean (NIO) spans far to the south. However, our back-trajectory analysis for all PHILEAS research flights (F02-F20) confirms that air masses from the northern Indian Ocean as well as from the Bay of Bengal have an impact on the PHILEAS flights (Fig. 3 of the main paper). The impact of NIO and BoB along the flight track of research flight F02 is show in Fig. 8 (of the main paper) and of NIO along the flight track of research flight F06 in Fig. 11 (of the main paper). The impact of northern Indian Ocean and the Bay of Bengal was also found in our previous studies of measurements during the StratoClim campaign 2017 (e.g. Vogel et al., 2023, Fig. 4). We agree with the reviewer that with the focus on anthropogenic pollution the marine regions play a minor role, however here in the present paper we are also interested in the impact of marine sources such as CH_2Br_2 and trimethylamine (TMA) in particles.

16. *Line 200-209: There is some redundant text in this area. The sentence that ends with 'remain in the stratosphere afterwards' is repeated twice, for example.*

    Yes, we agree that there is some redundancy. On the one hand, we shortened the paragraph following Reviewer #1's advice; on the other hand, we added some further explanations requested by Reviewer #2.

    To estimate dehydration, the minimum of the water vapour saturation mixing ratio with respect to ice ($H_2O_{sat,ice,min}$) along the back-trajectories is calculated based on ERA5 temperatures and pressures. Dehydration is only relevant in a first approximation for air masses that are transported from the troposphere into the lower stratosphere. Therefore, tropopause heights along the trajectories are used to check whether the trajectories originate in the troposphere before reaching $H_2O_{sat,ice,min}$ and remain in the stratosphere afterwards.

Trajectories originating in the stratosphere and being transported into the troposphere, but with only a very short residence time just below the tropopause, are filtered out. Air parcels along the flight track are marked as dehydrated when the following criteria are fulfilled: trajectory (at least 80% of the time) is below the tropopause before reaching $H_2O_{sat,ice,min}$ and above afterwards, in addition FISH H_2O measurements (total water) should be greater equal $H_2O_{sat,ice,min}$ and to exclude measurements inside of clouds, FISH RH_i has to be lower than 90%. We determined a value of 80% as threshold because the time periods of dehydration using thresholds of 70%, 80%, and 90% along the flight tracks remain nearly the same.

17. *Figure 3 and others: since there are ∼30,000 backward trajectories per flight (totaling ∼600,000 for 20 flights), I'm struggling to believe that the colorbars show an absolute number of backward trajectory endpoints. Is there a scalar applied? Perhaps I just need to be reassured by the authors that there are enough pixels to reach that large a number.*

    The color bars show the absolute number of backward trajectory endpoints without using any scaling. For all research flights (F02–F20) 589829 trajectories are calculated; 344156 of them reach the model boundary layer until 1 May 2023, the remaining trajectories represent older air masses that are not included in Fig. 3. Because we only show trajectories for measurements above 340 K potential temperatures 270519 trajectories contribute to Fig. 3a/b. The sensitivity of the number of trajectories on the size of longitude-latitude grid boxes in Fig. 3 of the main paper is demonstrated in Fig. 3 of this reply. We hope that we have convinced the reviewer that Fig. 3 of the main paper is correct.

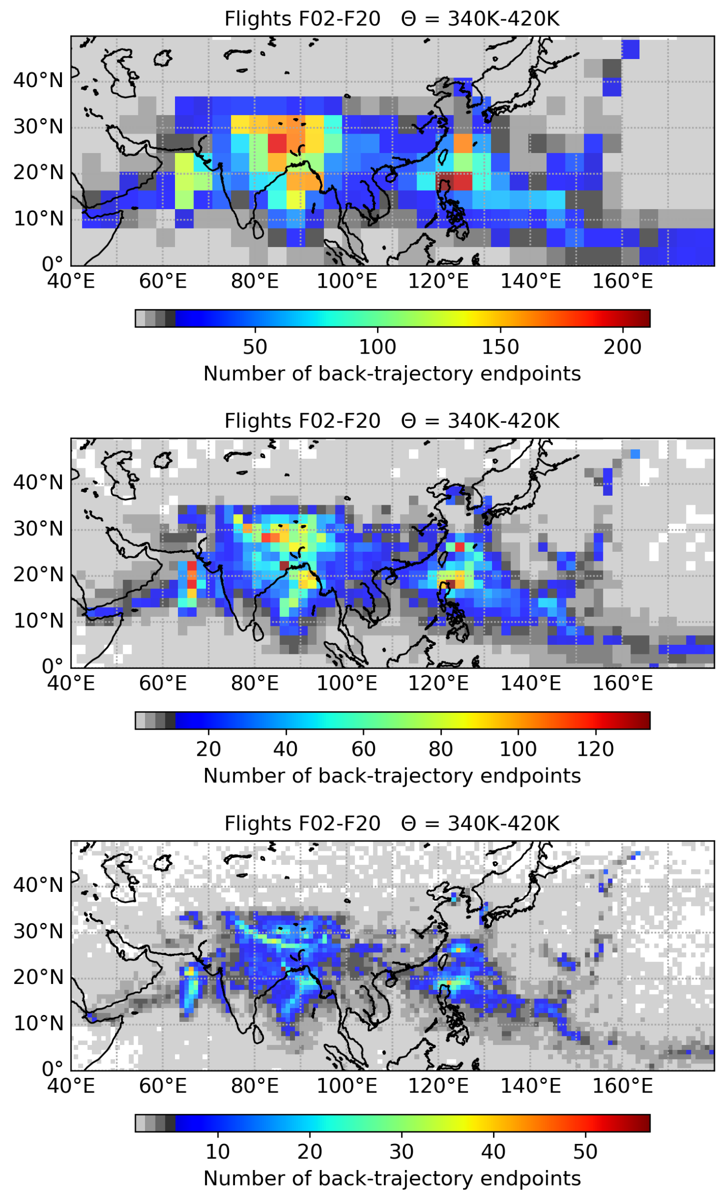

Figure 3: As Fig. 3 of the main paper, but with different grid box sizes ($4^\circ \times 4^\circ$, $2^\circ \times 2^\circ$ and $1^\circ \times 1^\circ$).

18. *Figure 4 and others: I don't personally like the Cyclone Category colorbar used on several figures, ranging from 2-6. For one, there is already a numerical scale for typhoon / hurricane categories, which could lead to confusion. Moreover, number 6 is numerically highest but refers to extra-tropical cyclones which are typically weak. I suggest assigning acronyms (perhaps TD, TS, STS, Typ, ExTC) to the colorbar labeling to help with reader comprehension.*

    Many thanks for this comment. We agree that using numbers as labels can lead to confusion. We changed the labels as shown in Fig. 4 of this reply and in all figures in our manuscript showing cyclone tracks.

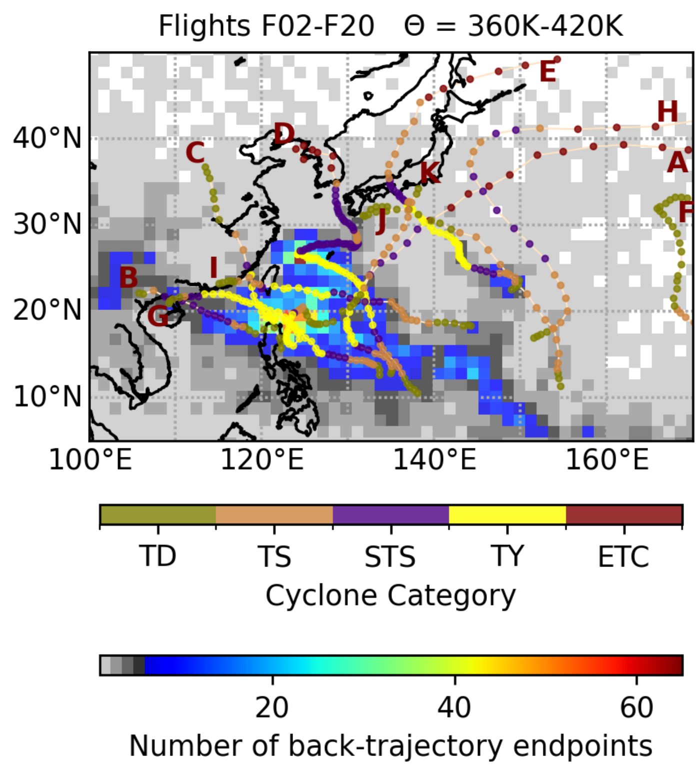

Figure 4: Frequency distribution of locations where air parcels were traced back to the model boundary layer using CLaMS back-trajectory calculations (for aircraft measurements taken above potential temperature levels of 360 K), overlaid with cyclone tracks in the western Pacific. Cyclone categories are indicated as follows: Tropical Depression (TD), Tropical Storm (TS), Severe Tropical Storm (STS), Typhoon (TY), Extra-tropical Cyclone (ETC). The following cyclones are included: (A) Guchol (6–16 June 2023), (B) Talim (13–18 July 2023), (C) Doksuri (20–30 July 2023), (D) Khanun (26 July – 11 August 2023), (E) Lan (7–18 August 2023), (F) Dora (12–22 August 2023), (G) Saola (22 August – 3 September 2023), (H) Damrey (23–30 August 2023), (I) Haikui (27 August – 6 September 2023) (J) Kirogi (29 August – 6 September 2023) and (K) Yun-Yeung (4–8 September 2023). The end of each cyclone track is marked by the corresponding capital letter.

19. *Line 279: I suggest replacing 'it turns out' with 'reveals'.*

    done

20. *Line 302: I suggest 'potential temperature levels'.*

    done

21. *Line 322: remove extra 'are'*

    done

22. *Line 342: Replace 'relative' with 'relatively'.*

    done

23. *Line 349: 'suggest' instead of 'yield'?*

    done

24. *Line 355: 'typhoon classification' instead?*

    We revised the sentence as follows:

    The trajectory endpoints in the model boundary layer have a strong coincidence with the track of tropical cyclone Doksuri in particular with the location where it is classified as a typhoon.

25. *Line 357: I suggest 'large fraction' instead of 'high fraction'.*

    done

26. *There are several places the authors refer to a 'calculated synoptic flight track position'. Why is this not just simply the 'flight track' using output provided by onboard instrumentation?*

    This is an important detail and needs clarification. To align the asynoptic measurement locations (the PHILEAS flights take over several hours) with the synoptic CLaMS model output at 12:00 (00:00) UTC, the actual flight positions were extrapolated to 12:00 (00:00) UTC positions using forward and backward CLaMS trajectories. We have added an additional panel zoomed on the flight track and showing both the synoptic and asynoptic flight track as shown in Figs. 5, 6 and 7 of this reply.

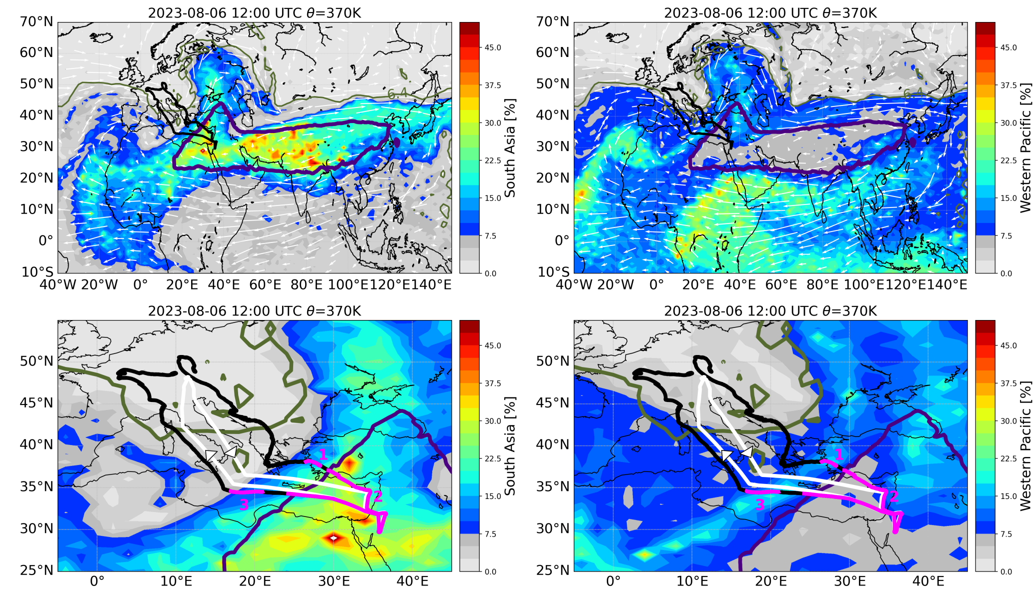

Figure 5: Research flight F02 on 6 August 2023 conducted from Oberpfaffenhofen, Germany, to the Mediterranean area intruding into the western part of the ASMA (South Asia surface–origin tracer at 370 K, 12:00 UTC, left). The entire anticyclone (top) as well as a zoom to the flight area (bottom) are shown. A belt of air from the western Pacific is found around the outer edge of the ASMA (Western Pacific surface–origin tracer at 370 K, 12:00 UTC, right). The surface–origin tracer distributions are based on a CLaMS simulation driven by ERA5. To align the flight tracks with the synoptic CLaMS model output at 12:00 UTC, the actual flight positions (white line) were extrapolated to 12:00 UTC positions using forward and backward CLaMS trajectories to calculate the synoptic HALO flight track (black line). To indicate the edge of the ASMA (indigo line), the boundary of the ASMA is calculated using the Montgomery streamfunction. An optimised Montgomery streamfunction value gives the ASMA boundary (MSF = 357.3 $\times 10^3$ $m^2 s^{-2}$) for 6 August 2023 at 12:00 and 370 K using ERA5 reanalysis data based on the method by Kachula et al. (2025). The climatological isentropic transport barrier (PV = 6.4 PVU) derived by Kunz et al. (2015) for the Northern Hemisphere at 370 K during summer indicates the barrier between the tropical tropopause layer and the extra-tropical lower stratosphere (olive line). Further, horizontal winds from ERA5 are indicated by white arrows. Time intervals 1–3 shown in Fig. 8 are marked in magenta.

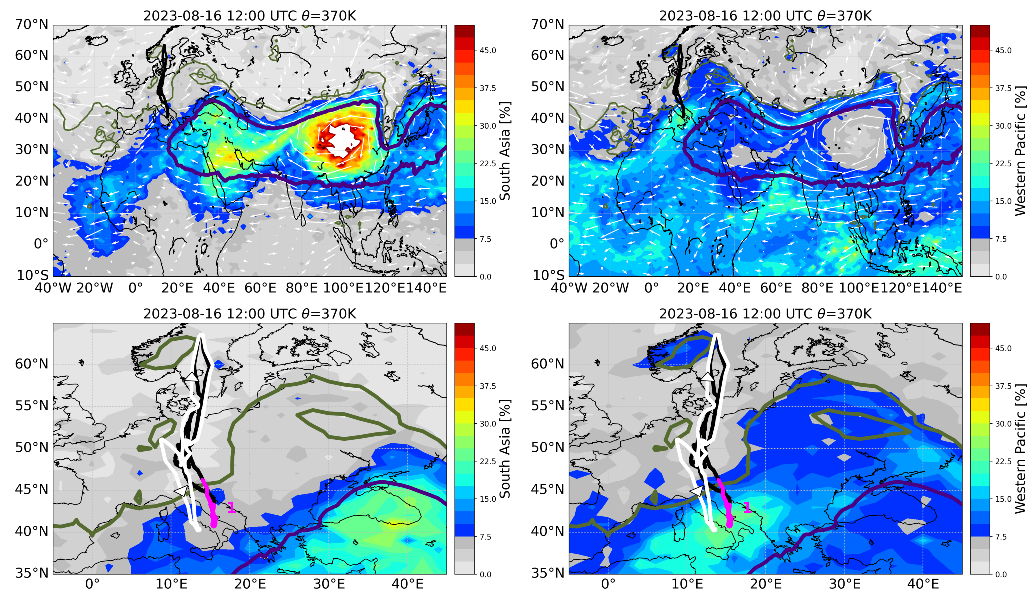

Figure 6: As in Fig. 5 but for research flight F06 on 16 August 2023 conducted from Oberpfaffenhofen, Germany, to the Mediterranean region (towards southern Italy). Research flight F06 reaches the outer edge of the ASMA (South Asia surface–origin tracer at 370 K, 12:00 UTC, left), which is dominated by air from the western Pacific (Western Pacific surface–origin tracer at 370 K, 12:00 UTC, right). The ASMA boundary (indigo line) is given by MSF = 356.6×10^3 m^2s^{-2} for 16 August 2023 at 12:00 UTC and 370 K. Time interval 1 shown in Fig. 11 is marked in magenta.

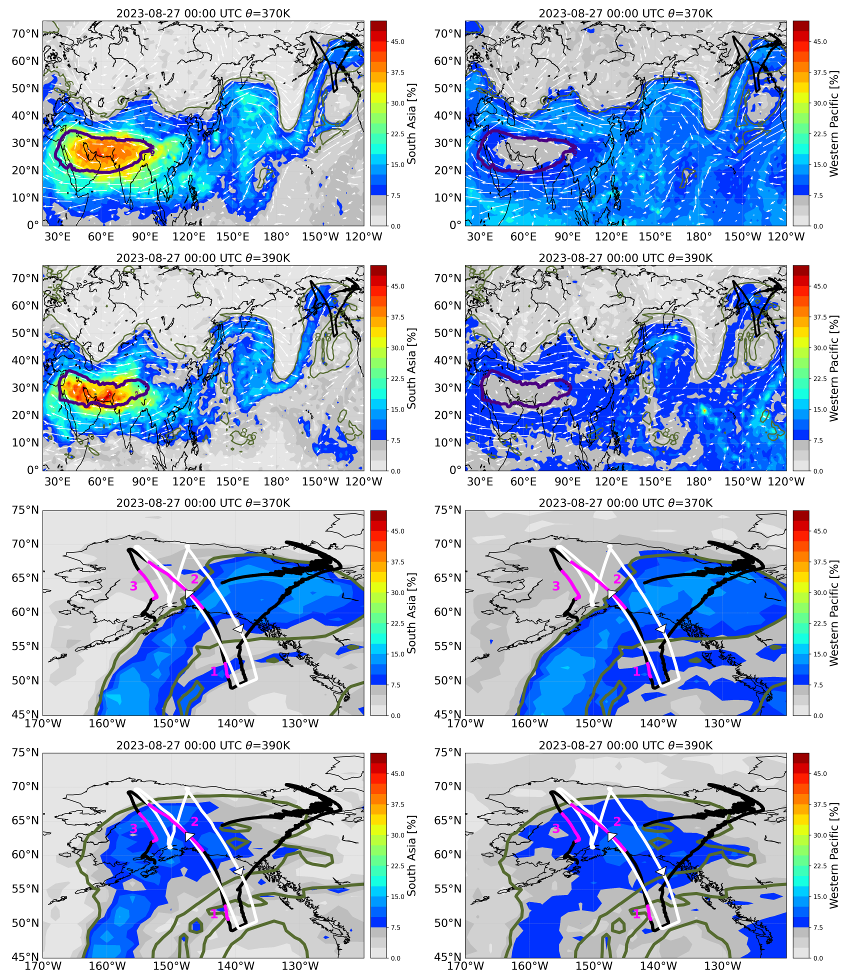

Figure 7: As in Fig. 5 but for research flight F08 on 26-27 August 2023 conducted from Anchorage probing a filament over Alaska separated from the ASMA (South Asia surface–origin tracer at 370 K and at 390 K, 00:00 UTC, left), which is mixed with air from the western Pacific (Western Pacific surface–origin tracer at 370 K and 390 K, 00:00 UTC, right). The calculated synoptic HALO flight track position at 27 August 2023 is shown at 00:00 UTC (black line). The ASMA boundaries (indigo line) are given by MSF = 357.0 $\times 10^3$ m^2s^{-2} at 370 K and MSF = 367.6 $\times 10^3$ m^2s^{-2} at 390 K for 27 August 2023 at 00:00. Climatological isentropic transport barriers (olive line) at 370 K (PV = 6.4 PVU) and at 390 K (8.6 PVU) are given.Time intervals 1–3 shown in Fig. 15 are marked in magenta.

27. *Figure 6 caption: I suggest specifying that horizontal winds are from ERA5 (if true).*

    done

28. *Figure 7 and others: The black line is labeled as 'potential temperature' in the legend, but the y-axis has the same label. Perhaps label the black line as the 'flight track' or 'HALO aircraft' in the legend instead.*

    We agree that the label 'potential temperature' is used twice: first on the left y-axis and second in the left legend. However, because two different y-axes and two different legends are used in a single figure, this approach provides a clear notation. Replacing the label 'potential temperature' with 'flight track', in our view, could instead lead to misunderstandings.

29. *Line 376: Why not call this region the 'Northwestern Pacific' for simplicity?*

    The Western Pacific tracer is the sum of the surface–origin tracers of Southeast Asia (SEA), Warm Pool (Wpool), Tropical Western Pacific (TWP) and Northern Western Pacific (NWP) (Fig. 2 of the main paper). In Fig. 10 of the main paper the Western Pacific tracer is shown, the Northern Western Pacific (NWP) contributes partly to the air masses shown here (see Fig. 11a in the main paper for details).

30. *Line 399: Replace 'anticyclonic' with 'anticyclonically'.*

    done

31. *Line 402: I suggest 'large amount' instead of 'high amount'. The latter can refer to either altitude or concentration.*

    done

32. *Figure 10 and 13: I suggest adding simplicity to these captions with 'As in Figure 6 but for flights on ...'*

    done

33. *Line 411: I think that rewriting this sentence to use 'positively/negatively correlated' would sound more scientific.*

    done

34. *Line 431: I suggest 'at the same potential temperature'.*

    done

35. *Line 433: typo, use 'occur'*

    done

36. *Line 444: typo, use 'from'*

    done

37. *Line 446: remove 'also' or move it to after 'Pacific'.*

    done

38. *Figure 15a: I am a bit confused at how small the ECH TWP and NWP contributions are compared to the red and blue lines for the aggregated contributions. Are we sure these are the important source regions here, or is there some issue with the plot?*

In Fig. 15a of the main paper, surface-origin tracers with fractions larger than 10% are shown. In Fig. 14 of the main paper, surface-origin tracers with fractions larger than 5% are shown demonstrating that plenty of surface-origin tracers contribute to the filament separated from the ASMA. This indicates that within the filament a mixture of air with different origins is found.

39. *Line 455: redundant 'found', I suggest ending the sentence with 'identified'.*

    done

40. *Line 468: I suggest rewriting the sentence to not imply that '>360K' is an altitude.*

    done

41. *Line 470: I gathered that the analysis was focused on both the western and eastern parts of the ASMA, but the text mentions only the western part.*

    For clarification we revised the sentence as follows.

    Our case studies of three single research flights (F02, F06, and F08) are focused on the western part of the ASMA – the eastern part was not reached during the PHILEAS flights – and likewise on its westward and eastward outflow at potential temperature levels $\geq 360\,K$.

42. *Line 487: The concept of Eastern China appears here, but all through the manuscript this was hidden behind the veil of a 'South Asia' label (see the first general remark).*

    See general comment item no. 2.

43. *It seems to me that Figure A2 belongs under the Appendix A1 header.*

    done

44. *Figure C1 caption should read '1 to 6 August'.*

    done

45. *Figure C2 caption line 4: 'anticyclonic' should be 'anticyclonically'.*

    done

46. *Line 516: I'm not sure if it's more appropriate to 'thank' or 'acknowledge' artificial intelligence, the authors can decide :)*

    Yes, we agree :). We would only mention that artificial intelligence was used to be in line with ACP rules. We changed the sentence as follows.

    ChatGPT was used for assistance with language refinement and Python programming.

47. *Note that the Pan et al. (2025) paper (https://doi.org/10.1029/2025JD044417) was just published, so this reference should be updated accordingly.*

    done

References

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